CCNA 200-301, Volume I

Chapter 8

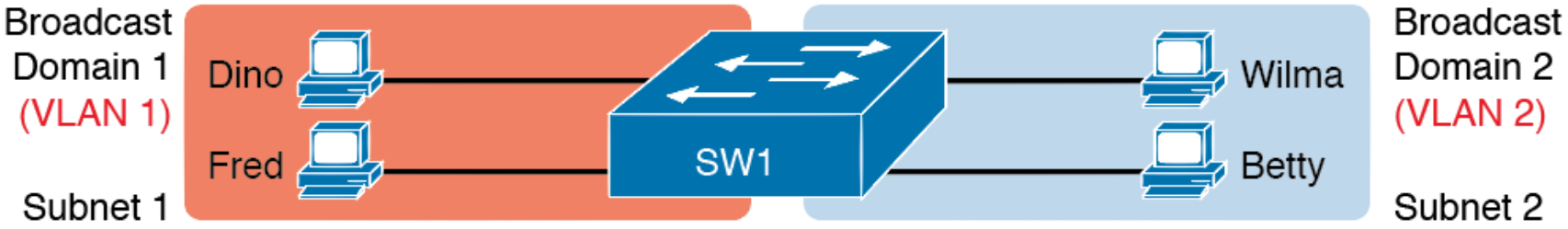
Implementing Ethernet Virtual LANs

Objectives

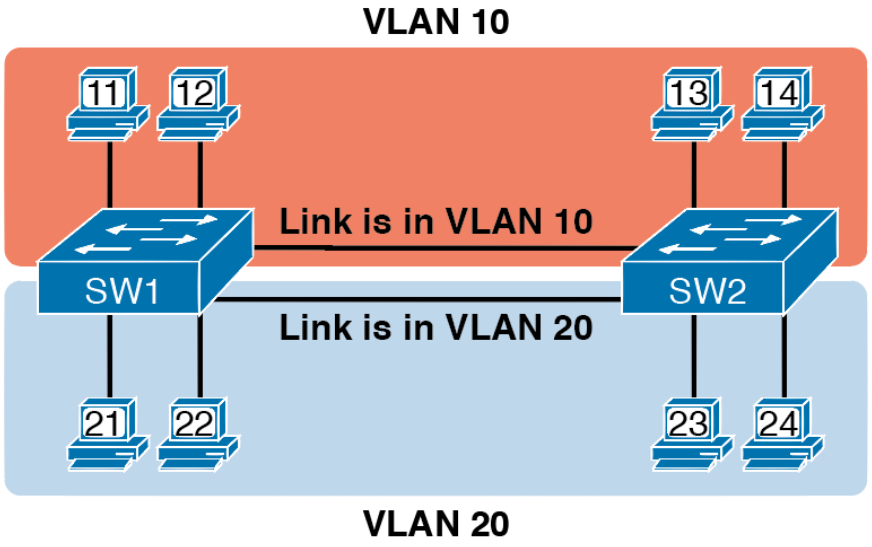
- Virtual LAN Concepts
- VLAN and VLAN Trunking Configuration and Verification
- Troubleshooting VLANs and VLAN Trunk

Creating Two Broadcast Domains with Two Physical Switches and No VLANs

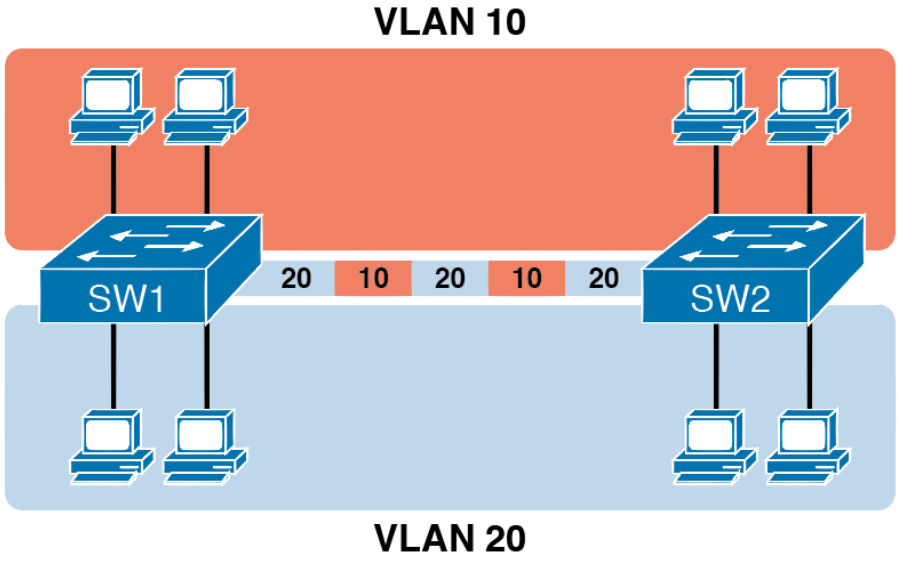
Creating Two Broadcast Domains Using One Switch and VLANs



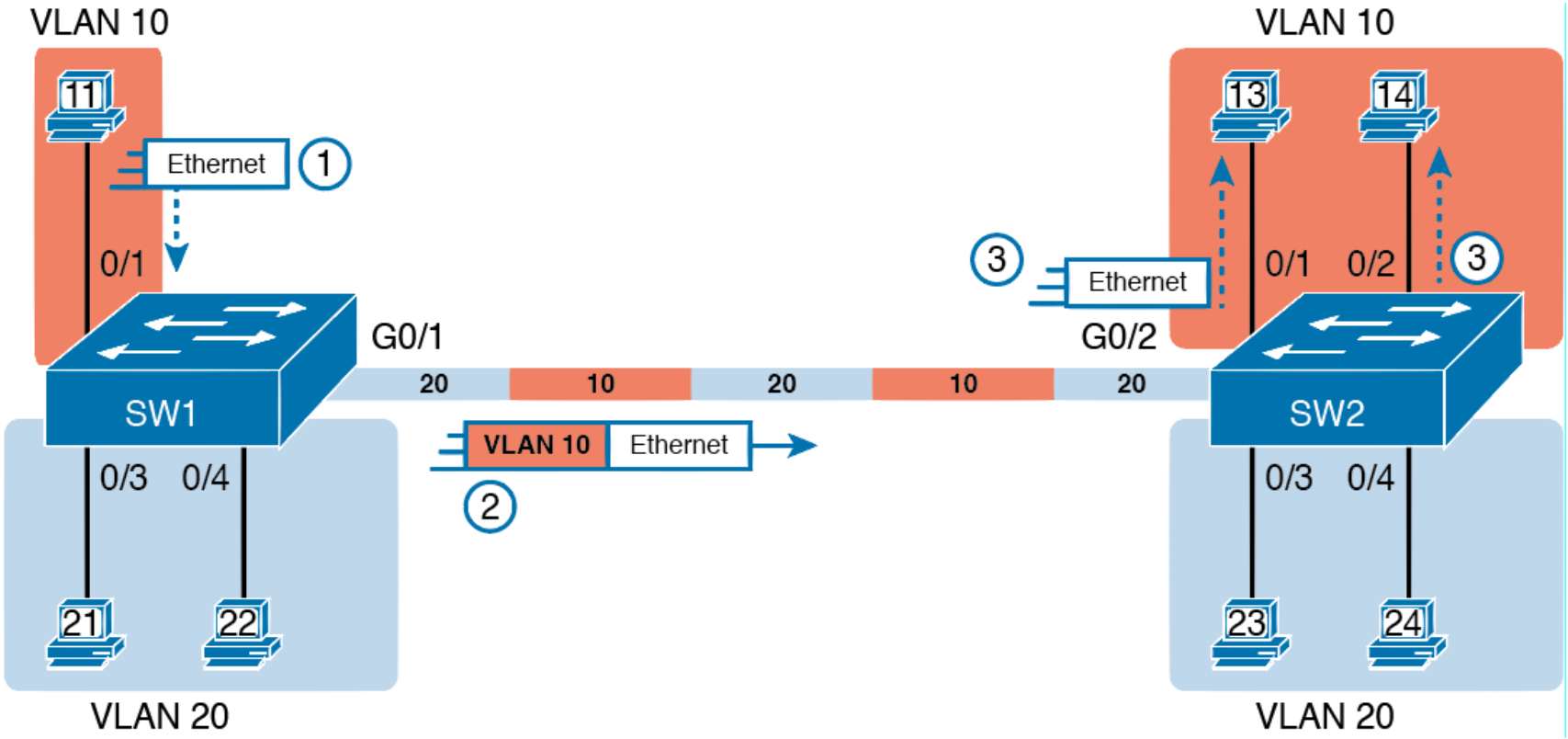
Multiswitch VLAN Without VLAN Trunking



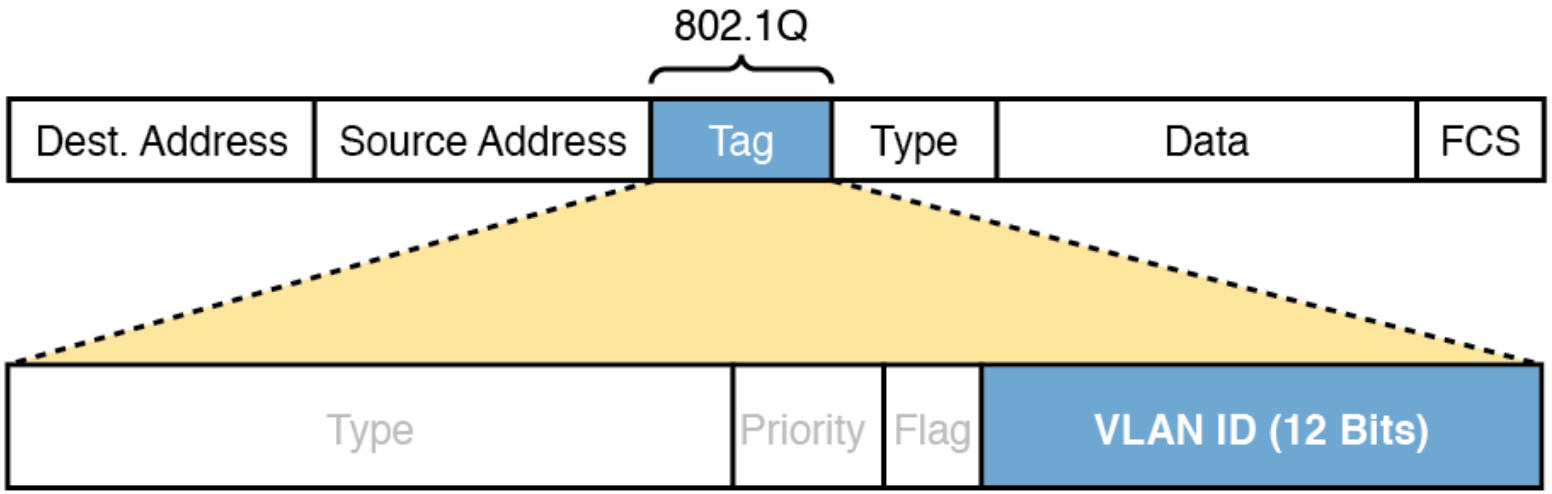
Multiswitch VLAN with Trunking



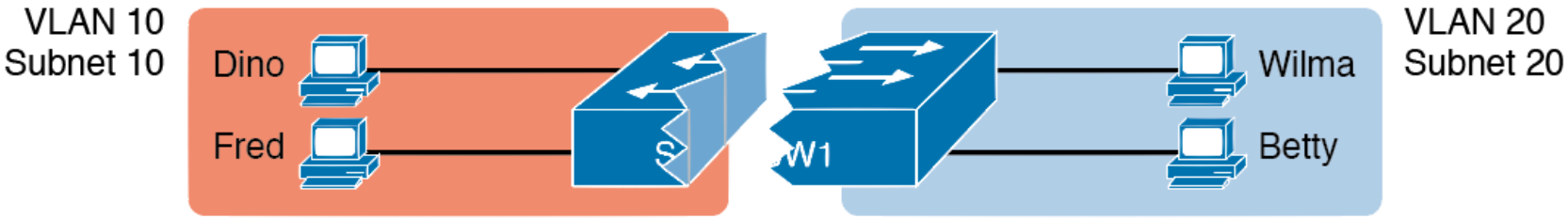
VLAN Trunking Between Two Switches



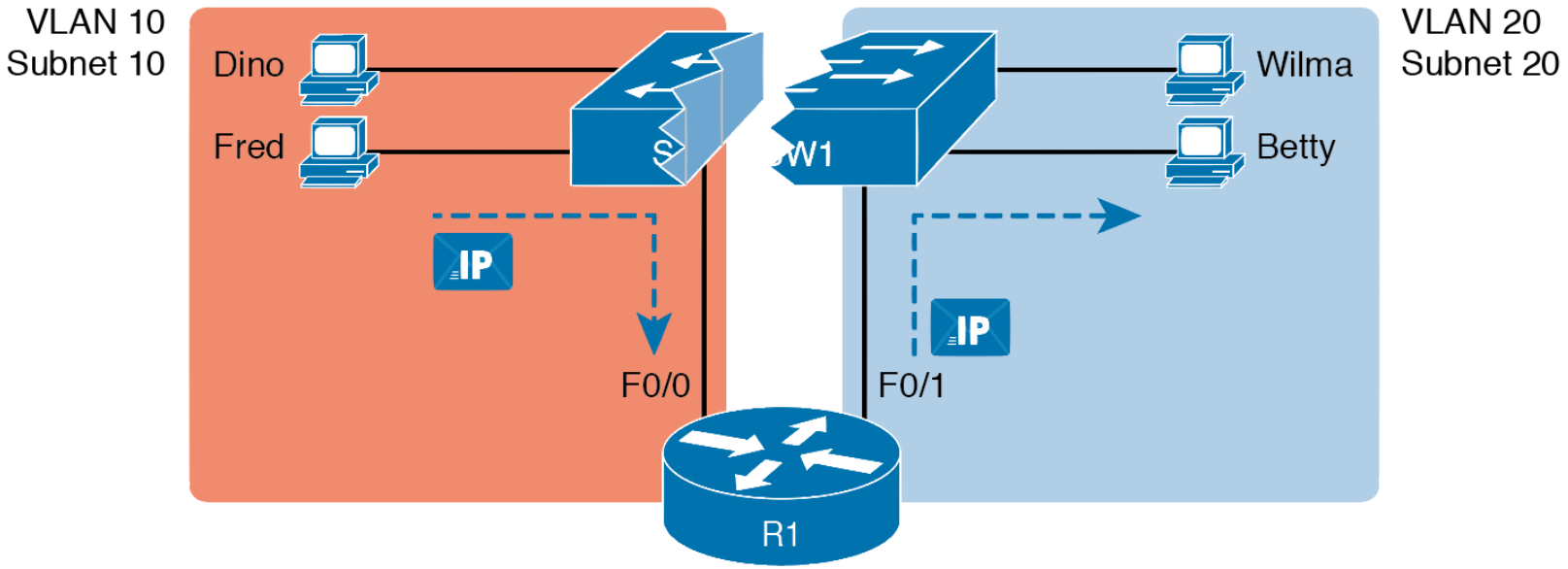
802.1Q Trunking



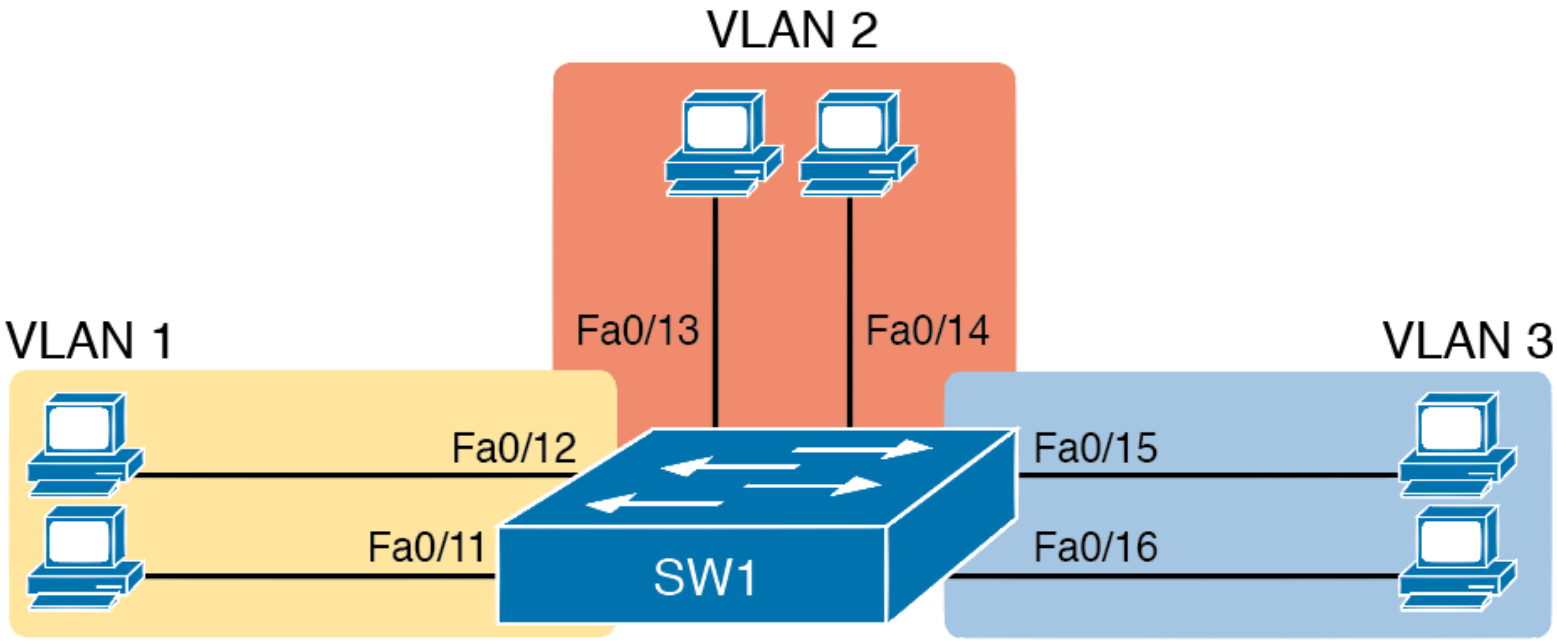
Layer 2 Switch Does Not Route Between the VLANs



Routing Between Two VLANs on Two Physical Interfaces



Network with One Switch and Three VLANs



Configuring VLANs and Assigning VLANs to Interfaces

```
SW1# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
SW1(config)# vlan 2
SW1(config-vlan)# name Freds-vlan
SW1(config-vlan)# exit
SW1(config)# interface range fastethernet 0/13 - 14
SW1(config-if)# switchport access vlan 2
SW1(config-if)# switchport mode access
SW1(config-if)# end

SW1# show vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
                                                Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                                Fa0/9, Fa0/10, Fa0/11, Fa0/12
                                                Fa0/15, Fa0/16, Fa0/17, Fa0/18
                                                Fa0/19, Fa0/20, Fa0/21, Fa0/22
                                                Fa0/23, Fa0/24, Gi0/1, Gi0/2
2    Freds-vlan                       active    Fa0/13, Fa0/14
1002 fddi-default                     act/unsup
1003 token-ring-default               act/unsup
1004 fddinet-default                  act/unsup
1005 trnet-default                    act/unsup
```

Configuring VLANs and Assigning VLANs to Interfaces (Continued)

```
SW1# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
SW1(config)# vlan 2
SW1(config-vlan)# name Freds-vlan
SW1(config-vlan)# exit
SW1(config)# interface range fastethernet 0/13 - 14
SW1(config-if)# switchport access vlan 2
SW1(config-if)# switchport mode access
SW1(config-if)# end

SW1# show vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
                                                Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                                Fa0/9, Fa0/10, Fa0/11, Fa0/12
                                                Fa0/15, Fa0/16, Fa0/17, Fa0/18
                                                Fa0/19, Fa0/20, Fa0/21, Fa0/22
                                                Fa0/23, Fa0/24, Gi0/1, Gi0/2
2    Freds-vlan                       active    Fa0/13, Fa0/14
1002 fddi-default                     act/unsup
1003 token-ring-default               act/unsup
1004 fddinet-default                  act/unsup
1005 trnet-default                    act/unsup
```

Configuring VLANs and Assigning VLANs to Interfaces (Continued)

```
SW1# show running-config
! Many lines omitted for brevity
! Early in the output:
vlan 2
 name Freds-vlan
!
! more lines omitted for brevity
interface FastEthernet0/13
 switchport access vlan 2
 switchport mode access
!
interface FastEthernet0/14
 switchport access vlan 2
 switchport mode access
!

SW1# show vlan id 2
VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
2    Freds-vlan                       active    Fa0/13, Fa0/14

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------
2    enet  100010     1500  -      -      -        -    -        0      0

Remote SPAN VLAN
----------------
Disabled

Primary Secondary Type              Ports
------- --------- ----------------- ------------------------------------------
```

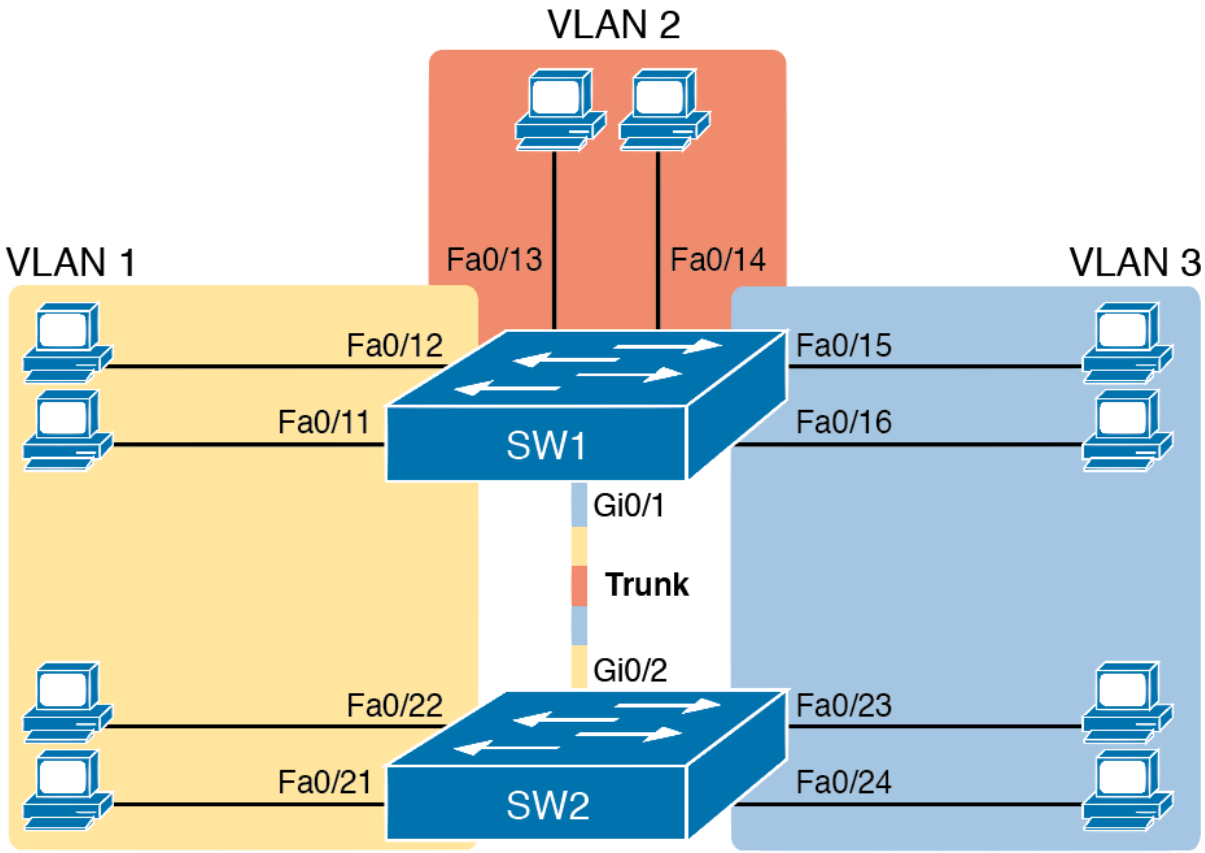
Shorter VLAN Configuration Example (VLAN 3)

```
SW1# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
SW1(config)# interface range Fastethernet 0/15 - 16
SW1(config-if-range)# switchport access vlan 3
% Access VLAN does not exist. Creating vlan 3
SW1(config-if-range)# ^Z

SW1# show vlan brief

VLAN Name                              Status    Ports
---- --------------------------------- --------- -------------------------------
1 default                              active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
                                                 Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                                 Fa0/9, Fa0/10, Fa0/11, Fa0/12
                                                 Fa0/17, Fa0/18, Fa0/19, Fa0/20
                                                 Fa0/21, Fa0/22, Fa0/23, Fa0/24
                                                 Gi0/1, Gi0/2
2 Freds-vlan                           active    Fa0/13, Fa0/14
3 VLAN0003                             active    Fa0/15, Fa0/16
1002 fddi-default                      act/unsup
1003 token-ring-default                act/unsup
1004 fddinet-default                   act/unsup
1005 trnet-default                     act/unsup
```

Trunking Administrative Mode Options with the **switchport mode** Command

Command Option	Description
access	Always act as an access (nontrunk) port
trunk	Always act as a trunk port
dynamic desirable	Initiates negotiation messages and responds to negotiation messages to dynamically choose whether to start using trunking
dynamic auto	Passively waits to receive trunk negotiation messages, at which point the switch will respond and negotiate whether to use trunking

Network with Two Switches and Three VLANs



Initial (Default) State: Not Trunking Between SW1 and SW2

```
SW1# show interfaces gigabit 0/1 switchport
Name: Gi0/1
Switchport: Enabled
Administrative Mode: dynamic auto
Operational Mode: static access
Administrative Trunking Encapsulation: dot1q
Operational Trunking Encapsulation: native
Negotiation of Trunking: On
Access Mode VLAN: 1 (default)
Trunking Native Mode VLAN: 1 (default)
Administrative Native VLAN tagging: enabled
Voice VLAN: none
Access Mode VLAN: 1 (default)
Trunking Native Mode VLAN: 1 (default)
Administrative Native VLAN tagging: enabled
Voice VLAN: none
Administrative private-vlan host-association: none
Administrative private-vlan mapping: none
Administrative private-vlan trunk native VLAN: none
Administrative private-vlan trunk Native VLAN tagging: enabled
Administrative private-vlan trunk encapsulation: dot1q
```

Initial (Default) State: Not Trunking Between SW1 and SW2 (Continued)

```
Administrative private-vlan trunk normal VLANs: none
Administrative private-vlan trunk private VLANs: none
Operational private-vlan: none
Trunking VLANs Enabled: ALL
Pruning VLANs Enabled: 2-1001
Capture Mode Disabled
Capture VLANs Allowed: ALL

Protected: false
Unknown unicast blocked: disabled
Unknown multicast blocked: disabled
Appliance trust: none

! Note that the next command results in a single empty line of output.
SW1# show interfaces trunk
SW1#
```

SW1 Changes from Dynamic Auto to Dynamic Desirable

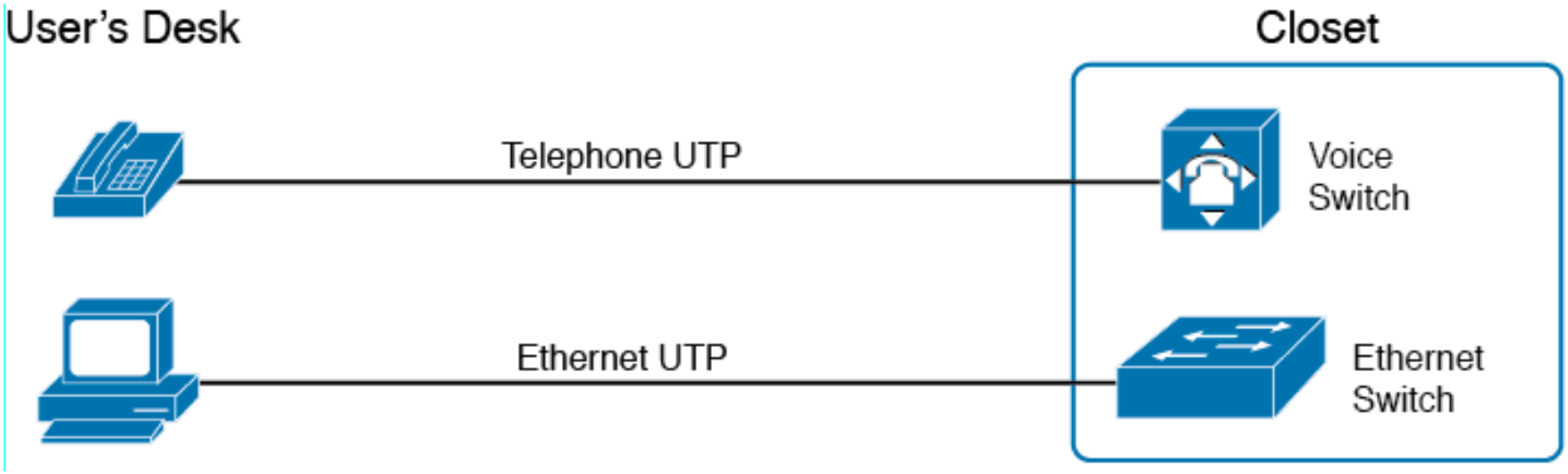
```
SW1# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
SW1(config)# interface gigabit 0/1
SW1(config-if)# switchport mode dynamic desirable
SW1(config-if)# ^Z
SW1#
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to
  down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to
  up
SW1# show interfaces gigabit 0/1 switchport
Name: Gi0/1
Switchport: Enabled
Administrative Mode: dynamic desirable
Operational Mode: trunk
Administrative Trunking Encapsulation: dot1q
Operational Trunking Encapsulation: dot1q
Negotiation of Trunking: On
Access Mode VLAN: 1 (default)
Trunking Native Mode VLAN: 1 (default)
! lines omitted for brevity
```

Expected Trunking Operational Mode Based on the Configured Administrative Modes

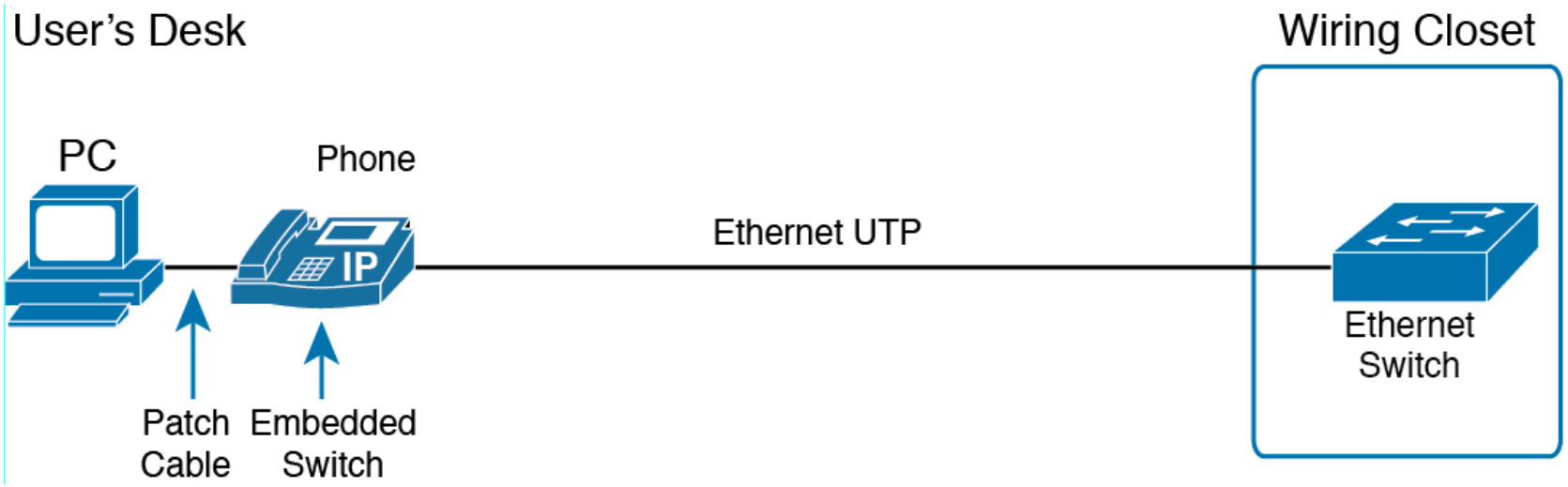
Administrative Mode	Access	Dynamic Auto	Trunk	Dynamic Desirable
access	Access	Access	Do Not Use[1]	Access
dynamic auto	Access	Access	Trunk	Trunk
trunk	Do Not Use[1]	Trunk	Trunk	Trunk
dynamic desirable	Access	Trunk	Trunk	Trunk

[1] When two switches configure a mode of "access" on one end and "trunk" on the other, problems occur. Avoid this combination.

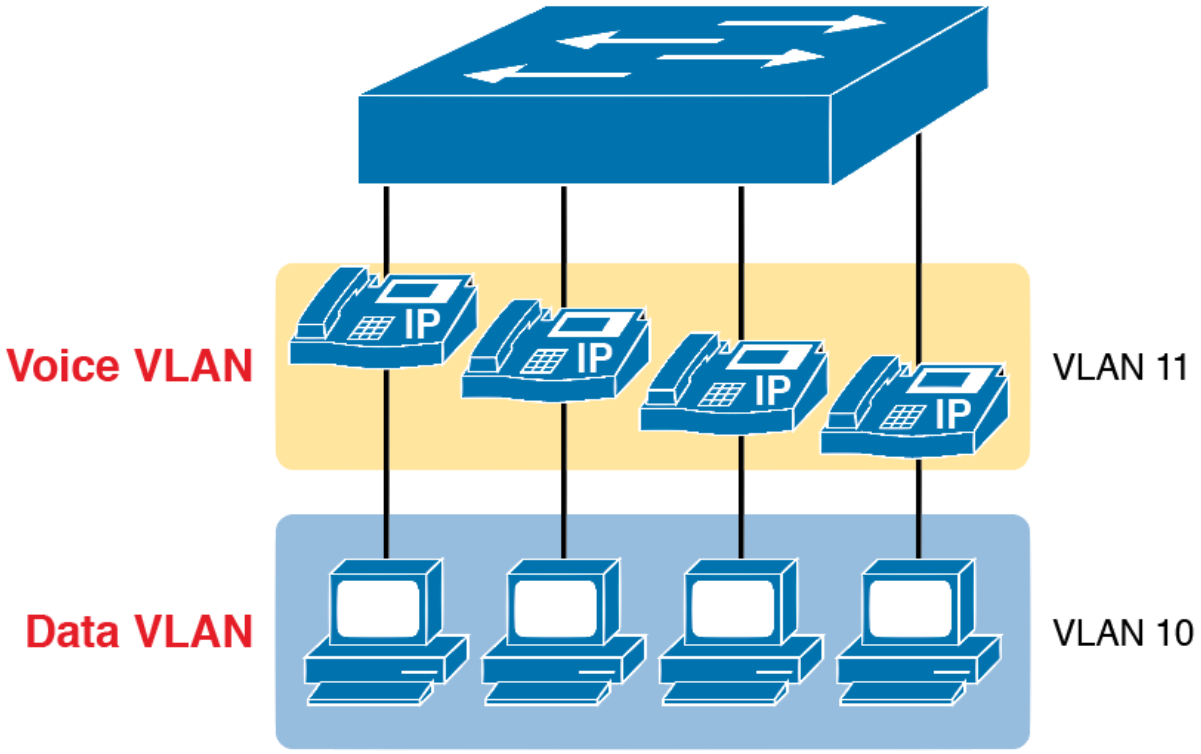
Before IP Telephony: PC and Phone, One Cable Each, Connect to Two Different Devices



Cabling with an IP Phone, a Single Cable, and an Integrated Switch



A LAN Design, with Data in VLAN 10 and Phones in VLAN 11



Configuring the Voice and Data VLAN on a Ports Connected to Phones

```
SW1# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
SW1(config)# vlan 10
SW1(config-vlan)# vlan 11
SW1(config-vlan)# interface range FastEthernet0/1 - 4
SW1(config-if)# switchport mode access
SW1(config-if)# switchport access vlan 10
SW1(config-if)# switchport voice vlan 11
SW1(config-if)#^Z
SW1#
```

Verifying the Data VLAN (Access VLAN) and Voice VLAN

```
SW1# show interfaces FastEthernet 0/4 switchport
Name: Fa0/4
Switchport: Enabled
Administrative Mode: static access
Operational Mode: static access
Administrative Trunking Encapsulation: dot1q
Operational Trunking Encapsulation: native
Negotiation of Trunking: Off
Access Mode VLAN: 10 (VLAN0010)
Trunking Native Mode VLAN: 1 (default)
Administrative Native VLAN tagging: enabled
Voice VLAN: 11 (VLAN0011)
! The rest of the output is omitted for brevity
```

Allowed VLAN List and the List of Active VLANs

```
SW1# show interfaces trunk
SW1# show interfaces F0/4 trunk

Port        Mode             Encapsulation  Status        Native vlan
Fa0/4       off              802.1q         not-trunking  1

Port        Vlans allowed on trunk
Fa0/4       10-11

Port        Vlans allowed and active in management domain
Fa0/4       10-11

Port        Vlans in spanning tree forwarding state and not pruned
Fa0/4       10-11
```

Enabling and Disabling VLANs on a Switch

```
SW2# show vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
                                                Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                                Fa0/9, Fa0/10, Fa0/11, Fa0/12
                                                Fa0/14, Fa0/15, Fa0/16, Fa0/17
                                                Fa0/18, Fa0/19, Fa0/20, Fa0/21
                                                Fa0/22, Fa0/23, Fa0/24, Gi0/1
10   VLAN0010                         act/lshut Fa0/13
20   VLAN0020                         active
30   VLAN0030                         act/lshut
```

Enabling and Disabling VLANs on a Switch (Continued)

```
40   VLAN0040                         active
1002 fddi-default                     act/unsup
1003 token-ring-default               act/unsup
1004 fddinet-default                  act/unsup
1005 trnet-default                    act/unsup

SW2# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
SW2(config)# no shutdown vlan 10
SW2(config)# shutdown vlan 20
SW2(config)# vlan 30
SW2(config-vlan)# no shutdown
SW2(config-vlan)# vlan 40
SW2(config-vlan)# shutdown
```

Operational Trunking State

```
SW2# show interfaces gigabit0/2 switchport
Name: Gi0/2
Switchport: Enabled
Administrative Mode: dynamic auto
Operational Mode: static access
Administrative Trunking Encapsulation: dot1q
Operational Trunking Encapsulation: native
! lines omitted for brevity
```

Mismatched Trunking Operational States